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Appl. No. 10/559,641

Reply to Office Action mailed May 27, 2008

Amendment to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1. (currently amended) A surface-treated steel sheet with excellent corrosion resistance comprising:

a zinc-based plated steel sheet or an aluminum-based plated steel sheet;

a surface-treatment coating disposed on a surface of the plated steel sheet having a coating thickness ranging from 0.01 to 1 μm , and being formed by applying and drying a surface-treatment coating composition which contains ingredients (a) through (c) described below ~~on a surface of the plated steel sheet~~; and

a top coating having a coating thickness ranging from 0.3 to 2 μm , and being formed by applying and drying a coating composition for top coating, containing an (E) high molecular weight epoxy group-containing resin having a number average molecular weight ranging from 6000 to 20000 on the surface-treatment coating:

(a) a water-epoxy resin dispersion which is prepared by dispersing in water a resin obtained by a reaction of: an (A)

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polyalkyleneglycol-modified epoxy resin derived from a reaction of polyalkyleneglycol having a number average molecular weight ranging from 400 to 20000, a bisphenol type epoxy resin, an active hydrogen-containing compound for blocking an isocyanate group, and a polyisocyanate compound; a (B) epoxy group-containing resin other than the (A) polyalkyleneglycol-modified epoxy resin; and an active hydrogen-containing compound which reacts with an epoxy group in the (A) polyalkyleneglycol-modified epoxy resin and the (B) epoxy group-containing resin, a part or all of the active hydrogen-containing compound being ~~structured~~ by a (C) hydrazine derivative having active hydrogen;

(b) a silane coupling agent in an amount ranging from 1 to 300 parts by mass of solid matter therein to 100 parts by mass of the resin solid matter in the water-epoxy resin dispersion; and

(c) phosphoric acid and/or a hexafluorometal acid in an amount ranging from 0.1 to 80 parts by mass of solid matter therein to 100 parts by mass of the resin solid matter in the water-epoxy resin dispersion.

Claim 2. (original) The surface-treated steel sheet according to claim 1, wherein the (C) hydrazine derivative containing

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active hydrogen is at least one compound selected from the group consisting of a pyrazole compound and a triazole compound, which compound has a ring structure of five-membered ring or six-membered ring, and has nitrogen atom in the ring structure.

Claim 3. (previously presented) The surface-treated steel sheet according to claim 1, wherein the surface-treatment coating composition further contains a water-soluble phosphate in an amount ranging from 0.1 to 60 parts by mass of solid matter therein to 100 parts by mass of the resin solid matter in the water-epoxy resin dispersion of the ingredient (a).

Claim 4. (previously presented) The surface-treated steel sheet according to claim 1, wherein the surface-treatment coating composition further contains at least one non-chromium based rust inhibitor in an amount ranging from 0.1 to 50 parts by mass of solid matter therein to 100 parts by mass of the resin solid matter in the water-epoxy resin dispersion of the ingredient (a).

Claims 5 to 8. (canceled)

Claim 9. (previously presented) The surface-treated steel sheet according to claim 1, wherein the coating composition for top coating further contains at least one non-chromium based rust

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inhibitor in an amount ranging from 0.1 to 50 parts by mass of solid matter therein to 100 parts by mass of the resin solid matter in the coating composition.

Claim 10. (previously presented) The surface-treated steel sheet according to claim 4, wherein the at least one non-chromium based rust inhibitor is selected from the group consisting of

- (e1) silicon oxide,
- (e2) calcium and/or a calcium compound,
- (e3) a slightly-soluble phosphoric acid compound,
- (e4) a molybdic acid compound,
- (e5) a vanadium compound,
- (e6) an organic compound containing a S atom, being one or more compounds selected from the group consisting of triazole, thiol, thiaziazole, thiazole and thiuram and

(e7) an organic compound containing a N atom, being one or more compounds selected from the group consisting of a hydrazide compound, a pyrazole compound, a triazole compound, a tetrazole compound, a thiaziazole compound and a pyridazine compound.

Claim 11. (previously presented) The surface-treated steel sheet according to claim 9, wherein the at least one non-chromium based rust inhibitor is selected from the group consisting of

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- (e1) silicon oxide,
- (e2) calcium and/or a calcium compound,
- (e3) a slightly-soluble phosphoric acid compound,
- (e4) a molybdic acid compound,
- (e5) a vanadium compound,
- (e6) an organic compound containing a S atom, being one or more compounds selected from the group consisting of triazole, thiol, thiaziazole, thiazole and thiuram and
- (e7) an organic compound containing a N atom, being one or more compounds selected from the group consisting of a hydrazide compound, a pyrazole compound, a triazole compound, a tetrazole compound, a thiaziazole compound and a pyridazine compound.

Claim 12. (previously presented) The surface-treated steel sheet according to claim 1, wherein the coating composition for top coating further contains a curing agent having a group which crosslinks with a hydroxyl group, in an amount ranging from 1 to 50 parts by mass of solid matter therein to 100 parts by mass of the solid matter in the (E) high molecular weight epoxy group-containing resin.

Claim 13. (previously presented) The surface-treated steel sheet according to claim 12, wherein the curing agent having a group crosslinking with a hydroxyl group is an (F) amino resin

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which has one or more imino groups as an average within a single molecule thereof.

Claim 14. (previously presented) The surface-treated steel sheet according to claim 12, wherein the curing agent having a group crosslinking with a hydroxyl group is a (G) polyisocyanate compound which has four or more isocyanate groups as an average within a single molecule thereof.

Claim 15. (previously presented) The surface-treated steel sheet according to claim 14, wherein the (G) polyisocyanate compound has at least some of the isocyanate groups in the polyisocyanate compound which are blocked by a blocking agent.

Claim 16. (currently amended) The surface-treated steel sheet according to claim 1, wherein the (E) high molecular weight epoxy group-containing resin in the coating composition for top coating is a modified epoxy group-containing resin which is modified by an (H) active hydrogen-containing compound which reacts with an epoxy group, a part or all of the active hydrogen-containing compound is ~~structured by~~ an (I) hydrazine derivative having active hydrogen.

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Claim 17. (previously presented) The surface-treated steel sheet according to claim 1, wherein the coating composition for top coating further contains a solid lubricant in an amount ranging from 1 to 30 parts by mass of solid matter therein to 100 parts by mass of the resin solid matter in the coating composition.

Claim 18. (currently amended) A method for manufacturing surface-treated steel sheet with excellent corrosion resistance comprising the steps of:

(i) applying a surface-treatment coating composition which contains (a) a water-epoxy resin dispersion, (b) a silane coupling agent and (c) phosphoric acid and/or a hexafluorometal acid onto a surface of a zinc-based plated steel sheet or an aluminum-based plated steel sheet, and then drying the applied surface-treatment coating composition at an ultimate sheet temperature ranging from 30°C to 150°C, thus forming a surface-treatment coating having a coating thickness ranging from 0.01 to 1 μm ; and

(ii) forming a top coating having a coating thickness ranging from 0.3 to 2 μm on the surface-treatment coating by applying a coating composition for top coating containing an (E) high molecular weight epoxy group-containing resin having a

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number average molecular weight ranging from 6000 to 20000, and then by drying the applied coating composition for top coating at an ultimate sheet temperature ranging from 30°C to 150°C;

said water-epoxy resin dispersion (a) is prepared by dispersing in water a resin obtained by a reaction of: an (A) polyalkyleneglycol-modified epoxy resin derived from a reaction of polyalkyleneglycol having a number average molecular weight ranging from 400 to 20000, a bisphenol type epoxy resin, an active hydrogen-containing compound for blocking an isocyanate group, and a polyisocyanate compound; a (B) epoxy group-containing resin other than the (A) polyalkyleneglycol-modified epoxy resin; and an active hydrogen-containing compound which reacts with an epoxy group in the (A) polyalkyleneglycol-modified epoxy resin and the (B) epoxy group-containing resin, a part or all of the active hydrogen-containing compound being ~~structured by~~ a (C) hydrazine derivative having active hydrogen;

said silane coupling agent being in an amount ranging from 1 to 300 parts by mass of solid matter therein to 100 parts by mass of the resin solid matter in the water-epoxy resin dispersion; and

said phosphoric acid and/or a hexafluorometal acid (c) being in an amount ranging from 0.1 to 80 parts by mass of solid matter thereof to 100 parts by mass of the resin solid matter in the water-epoxy resin dispersion.

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Claim 19. (canceled)

Claim 20. (previously presented) The surface-treated steel sheet according to claim 2, wherein the surface-treatment coating composition further contains a water-soluble phosphate in an amount ranging from 0.1 to 60 parts by mass of solid matter therein to 100 parts by mass of the resin solid matter in the water-epoxy resin dispersion of the ingredient (a).

Claim 21. (canceled)

Claim 22. (currently amended) The surface-treated steel sheet according to claim 1, wherein the active-hydrogen containing compound for blocking an isocyanate group is selected from the group consisting of a monohydric alcohol, a monohydric carboxylic acid, a monohydric thiol, a secondary amine and an oxime compound.

Claim 23. (new) The surface-treated steel sheet according to claim 1, wherein the active-hydrogen containing compound for blocking an isocyanate group is selected from the group consisting of methanol, ethanol, diethylenglycol monobutyl ether, acetic acid, propionic acid, ethylmercaptan, diethylamine, methylethylketoxime, phenol and nonylphenol.

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Claim 24. (currently amended) The surface-treated steel sheet according to claim 16, wherein the active hydrogen-containing compound which reacts with an epoxy group is selected from the group consisting of carbohydrazide, hydrazide propionate, hydrazide salicylate, dihydrazide adipate, dihydrazide sebacylate, dihydrazide dodecanate, dihydrazide isophthalate, thiocarbohydrazide, 4,4'-oxybisbenzenesulfonyl hydrazide, benzophenone hydrazone and aminopolyacrylamide.